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PENSOFT

Unseen for 43 years! A new occurrence of *Glaucomys volans* (Linnaeus, 1758) (Rodentia, Sciuridae) in Honduras

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Abstract. We report an occurrence of *Glaucomys volans* (Linnaeus, 1758) in Honduras after 43 years since its last verified record. The observation was in an area in which forestry and silvicultural activities are carried out for the sustainable exploitation of logging and timber of *Pinus oocarpa* in Las Lechuzas, department of Olancho (eastern Honduras). This record supports the initiation of new conservation activities in areas in which forestry is being implemented; population studies and the protection of their refuges are the priorities at its southernmost locality.

Keywords. Central America, forestry management, pine forest, silvicultural activities, Southern Flying Squirrel

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Introduction

The order Rodentia has been poorly documented in Honduras, and the last accurate review of the group was by Goodwin (1942). Currently, the number of verified species from the country is unknown. Lately, studies on rodents have included *Peromyscus* Gloger, 1841 (Kilpatrick et al. 2021; Peréz-Consuegra and Vázquez-Domínguez 2016) and *Dasyprocta ruatanica* Thomas, 1901 (Teta and Reyes-Amaya 2021; Ruiz-García et al. 2022). Unfortunately, Honduras lacks systematic, taxonomic, and ecological information on almost all rodents that occur in the country, and there is no information even for common species such as squirrels (Sciuridae).

Among the unknown number of rodent species that may occur in Honduras, the squirrels are an understudied group. Three species have been found in the country since Goodwin's (1940) review: *Sciurus variegatoides* Ogilby, 1839 (presently it is unknown how many subspecies occur in the country and how they are distributed); *Sciurus deppei* Peters, 1863 (subspecies are also unknown, as for *S. variegatoides*); and *Glaucomys volans* (Linnaeus, 1758) (only *Glaucomys volans underwoodi* Goodwin, 1936 is known to occur in the country). Interestingly, Goodwin (1936) described a new subspecies of flying squirrel (*G. v. underwoodi*), collected by Cecil Underwood from a male from Zambrano, in the northern region of Francisco Morazán department in central Honduras. Goodwin (1936: 2) mentioned in his diagnosis that "all the forms of *Glaucomys volans* are closely

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allied, and, although widely separated geographically, *G. v. underwoodi* is not very different from forms that occur". Later, Goodwin (1942) referred to the species and mentioned that the only record was from Zambrano, based on the specimen captured in 1935. Then Goodwin (1961) reviewed specimens of the Southern Flying Squirrels (*G. volans*) from Middle America and mentioned that the material from Central American countries was scarce. Also, the only subspecies that Goodwin (1961) mentioned that occurred in the mountains of southern Honduras and Guatemala was *G. v. underwoodi*. However, Goodwin (1961) added two more records for the species in western Honduras that were captured in Gracias in the department of Lempira. Finally, Hall (1981), based on the records of Goodwin (1961), located Honduras as the southernmost extent for the distribution of *G. volans*. Those three records are the only ones available for Honduras, and there are no records for El Salvador and Nicaragua in the GBIF.org (2022) database.

Considering that after Goodwin (1961) and Leoni (1979) no new records have been reported, we present here a confirmed record of *G. volans* from Honduras after 43 years. This record represents the first report of the species in Olancho (eastern Honduras), in an area where silvicultural activities and logging are currently major activities.

Methods

The site in which *Glaucomys volans* was observed and photographed is known as Las Lechuzas, which is part of the municipality of Concordia in Olancho department. It is private property and belongs to the Sansone company. Las Lechuzas has a forest management plan (BP-OL-1504-0334-1995) approved by the Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre (ICF) for the sustainable exploitation of *Pinus oocarpa* Schiede ex Schltdl. Las Lechuzas has an overall area of 3139.62 ha, which is distributed as follows: 115.04 ha are designated for a plantation of *P. oocarpa* of an age less than 25 years; 122.20 ha is mixed forest, which includes a combination of several species of oaks (*Quercus* L.) and *P. oocarpa*; 521.44 has a medium-sized forest of pines, which usually have an age of 26–35 years; 786.54 ha is mature forest of pines with an age greater than 36 years; and 188.51 ha are a recently exploited forest of pines.

Results

***Glaucomys volans* (Linnaeus, 1758)**

Figures 1–4

Observation. HONDURAS – Olancho • Las Lechuzas, Concordia; 14°41′52″N, 086°43′24″W; alt. 856 m;

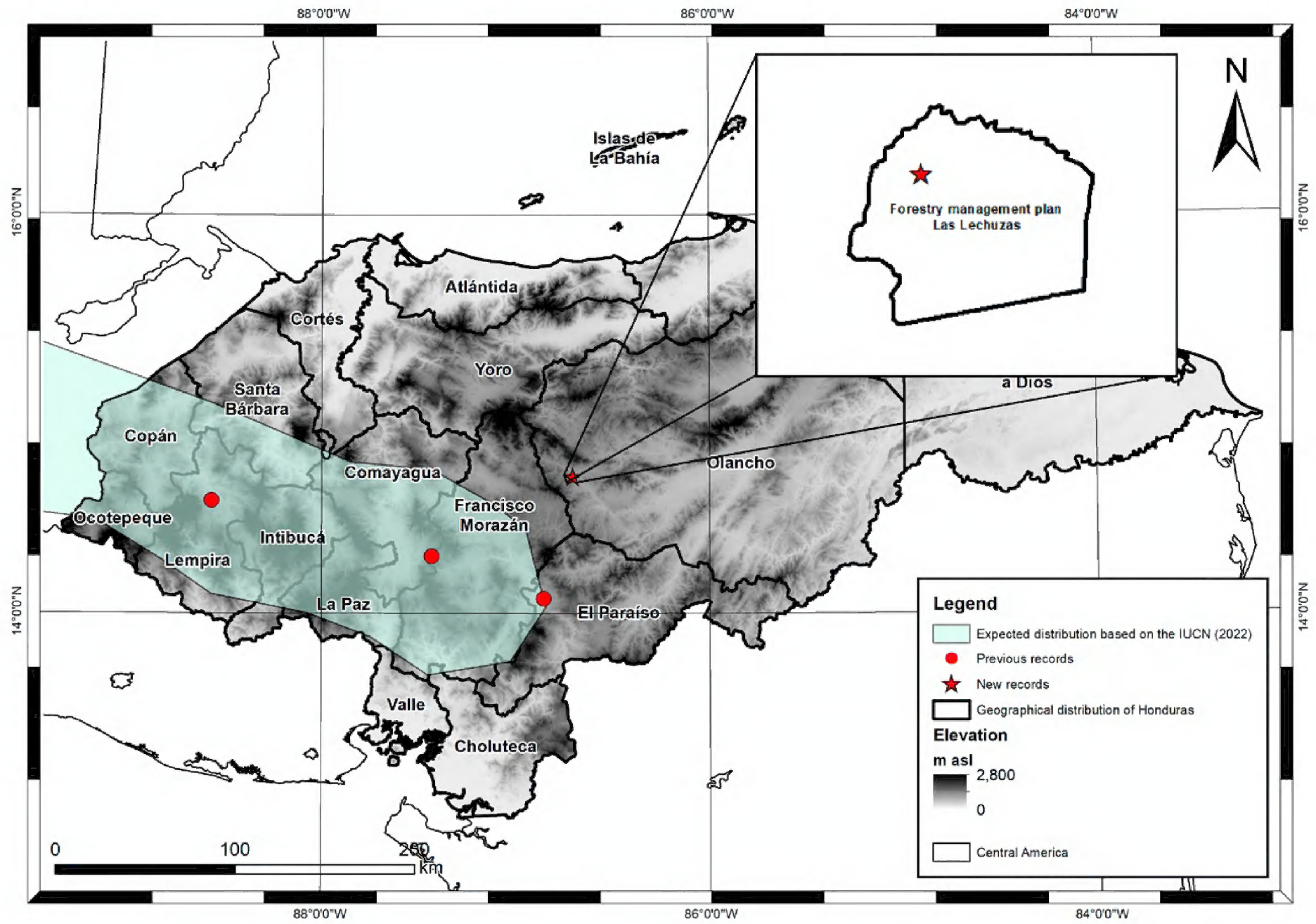

Figure 1. Distributional map of *Glaucomys volans* in Honduras. The shaded area is based on the distribution presented by the IUCN (2022). The records in Lempira department are those presented by Goodwin (1961); the record of Francisco Morazán was the new subspecies described by Goodwin (1936); the record from El Paraíso was described by Leoni (1979); and the new record in Olancho is presented here.

Figure 2. *Glaucomys volans*, behavior and habiat. **A.** *G. volans* before it started to glide to the oaks. **B.** A frightened *G. volans* exiting a nest-hole. **C.** Nest-hole was used by three *G. volans* in a pine tree. Photographs by MATC.

15.XI.2022; Zelaya & Sánchez obs.; 3 individuals, sex indet.

Identification. *Glaucomys volans* can be distinguished from the other squirrel species that occur in Honduras by the presence of gliding membranes between their limbs and by their dorsoventrally flattened tail (Goodwin 1936; Dolan and Carter 1977; Medina-Fitoria et al. 2018).

Distribution. *Glaucomys volans* is only known to occur in the departments of Francisco Morazán (Goodwin 1942), Lempira (Goodwin 1961), El Paraíso (Leoni 1979), and now Olancho (Fig. 1).

Remarks. The new record is based on an observation at 10:00 in a *P. oocarpa* tree that was surrounded by oaks. A group of three *G. volans* was seen by local people accompanying the technicians of Sansone company who were painting the trees for the identification of those to be cut. The squirrels were frightened by the guides when they struck their machetes against the trunk of the pines (Fig. 2A). They did that to observe if any

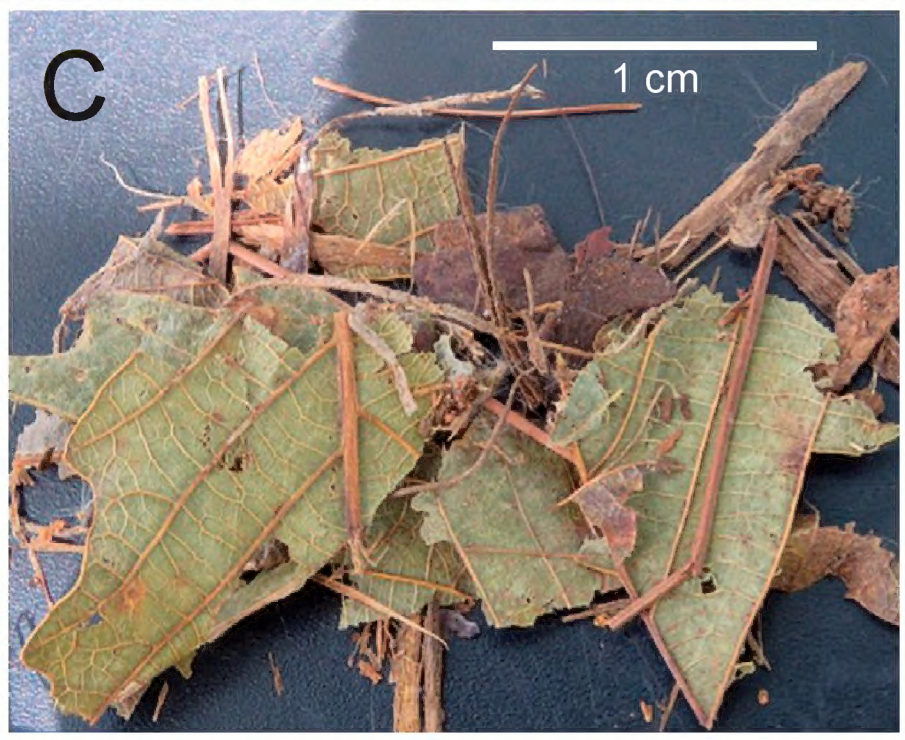

Figure 3. A. Secondary pine forest in which the nest-hole was found. **B.** Example of a handmade sling that is used in communities nearby Las Lechuzas. This photo was taken in Cruz Chiquita community, Francisco Morazán department. **C.** Remains found in the interior of nest-hole, and included needles of *P. oocarpa*, leaves of *Q. segoviensis*, leaves of "gallitos" and "paste de cerro" (Bromeliaceae), and lichens. Photographs by MATC.

wildlife was using pine trees with nest holes to avoid cutting those specific trees.

The nearby vegetation included *Quercus segoviensis* Liebm., *Leucaena* Benth. (Fabaceae; known as "quebracho" locally), Bromeliaceae ("gallitos" and "paste de cerro"), and Malpighiaceae ("nance de montaña"). The nearest stream was at 371 m from the pine tree.

Two of the three *G. volans* glided from a pine tree (Fig. 2B), in which a nest-hole (Fig. 2C) was encountered, to an oak (*Q. segoviensis*) that was 38 m downhill from the pine. Then they glided from one oak to another (4 m above the ground) which was 18 m away. Finally, they glided to another oak (2 m above the ground) 33 m away. The other *G. volans* remained in the pine tree within the secondary pine forest (Fig. 3A).

The interior of the nest-hole included needles of *P. oocarpa*, remains of leaves of *Q. segoviensis*, "gallitos", "paste de cerro", and lichens (Fig. 3C). The nest-hole was located 3 m above the ground in the pine tree and had a width of 5.1 cm, a length of 10.2 cm, and a depth of 40 cm.

Discussion

The new record not only represents a new locality for

¿EXISTE EN HONDURAS LA ARDILLA VOLADORA?

PENSAMIENTOS DE HONDUREÑOS ILUSTRES

Figure 4. The newspaper article by Leoni (1979) in which *Glaucomys volans* is described as being kept as a child's pet. Photograph reproduced from described by Leoni (1979). Photograph by CFM.

Glaucomys volans in Honduras, but it also is a rediscovery of this species after 43 years since its last verified record. At many sites in nearby Francisco Morazán department, where we have been exploring pine forests, local people have reported the presence of flying squirrels. However, we believe that the identifications were erroneous, most mistaken for *S. variegatoides* (known as "moritas"). Our finding confirmed that there is at least one population of *G. volans* in the country, in Las Lechuzas, which currently also is the southernmost known locality in its global distribution.

As indicated by Medina-Fitoria et al. (2018), the genus *Pinus* has its southernmost distribution in Nicaragua, and, therefore, we suspect that *G. volans* may occur in Nicaragua. Medina-Fitoria et al. (2018) reviewed the squirrels of Nicaragua and included *G. volans* in the species list of that country. The evidence presented by Medina-Fitoria et al. (2018) included two direct observations: the first was a decomposed individual from the municipality of San Fernando, but this specimen was not preserved because there was no museum in Nicaragua at that time that would provide suitable conditions for its preservation; the other observation was made during the night in the municipality of Mozonte. Medina-Fitoria et al. (2018) mentioned these records as new southernmost distributional limits of this species; the previous southernmost locality was an animal kept as pet in the department of El Paraíso (Leoni 1979) (Fig. 4). However, Nicaragua still lacks verifiable evidence of the occurrence of *G. volans*. For purposes of the verified occurrence of the individuals of this species in Honduras, we will consider only the distribution proposed by Cassola (2016) for Central America, which is based on the records presented by Goodwin (1961). However, we cannot exclude the possibility that *G. volans* may occur in other pine forests of Honduras and Nicaragua. We recommend an intensive monitoring for this species in both Nicaragua and Honduras.

The species has been assessed as Least Concern by the IUCN (Cassola 2016), but it is considered Data Deficient in the Red List of the Honduran species (WCS 2021). Considering the scarce number of records, the unverified records from Nicaragua (Medina-Fitoria et al. 2018) and Honduras (Marineros and Martínez 1998), and the high rate at which pine forests are being destroyed in Honduras, *G. volans* is a priority species for conservation in Honduras.

Goodwin (1942) described the locality of Zambrano as a secondary forest of mostly pines with nearby farms and plantations. In comparison, there was no mature pine forest where the new observation of *G. volans* was made—no changes in the landscape have been made since 2010—and corn fields and cattle pastures can be found at the site as well. Dolan and Carter (1977) indicated that *G. volans* also inhabits mixed woodlands, especially where the hardwoods are predominant. The new record is within the elevational range (365–914 m as.l.) mentioned by Goodwin (1961) and Dolan and Carter (1977) for Central America.

In addition to these habitat restrictions for *G. volans* in Honduras, Marineros and Martínez (1998) mentioned that this species may use nests of "chejes" (a traditional name for woodpeckers in Honduras). However, local people from the communities surrounding Las Lechuzas said that flying squirrels preferred abandoned nests of "chacos". In Las Lechuzas, local people differentiated woodpeckers into two groups, the common species, *Melanerpes formicivorus* (Swainson, 1827), which is known as "chaco", and another species known as "carpinteros" (a Spanish word for woodpecker). Based on the experience of the local people, the nest was made by a "chaco" and not by a "carpintero". This is an important conservation fact, because local people from Las Lechuzas, occasionally, hunt "chacos" with handmade slings (Fig. 3B), and they may fry, boil, roast, or cook them in "tamales" (a local corn-based food in Honduras generally stuffed with meat, in this case, "chacos"). This could be an indirect threat to *G. volans* because it seems that at least in Las Lechuzas, this species is using the nests of *M. formicivorus*. The illegal hunting of "chacos" may decrease the number of refuges that *G. volans* may use. However, the usage of woodpecker nests by *G. volans* in pine-oak forests in central Mexico seems rare and has been found more often in mature forests (Campuzano-Chávez-Peón et al. 2014). Nest availability is one of the main structural features that limit the

reproduction of the *G. volans* in managed landscapes. The availability of cavity trees and large overstorey mast trees are important for the productivity of females in fragmented forest patches (Jacques et al. 2017).

An individual of *G. volans* in Las Lechuzas was seen to glide 89 m in less than 2 minutes; however, the slope of the glides range from 31 to 60%. We consider these glides unusually long because they normally are 6–9 m (McCabe 1947; Dolan and Carter 1977).

We attribute the low number of records from Honduras to extensive illegal logging. For example, from 2000 to 2018 there has been a loss of 6225 ha per year in the conifer ecosystems of Honduras (ICF 2022). Also, tree mortality caused by diseases related to bark beetles (*Dendroctonus frontalis* Zimmerman, 1868 and *Ips* De Geer, 1775), and poor silvicultural management (i.e., wrong selection of seedlings and over-exploitation) have led to the loss of many pine ecosystems.

In support of the conservation of Las Lechuzas biodiversity, the Sansone company is now committed to give conservation priority to *G. volans* in the area. The use of artificial refuges is also being studied because *G. volans* is at greater risk when nesting is disturbed (Taulman and Smith 2004; Campuzano-Chávez-Peón et al. 2014). In addition to Ivey (1959), Moore (1947), and Dolan and Carter (1977), this is the first description of a refuge used by a flying squirrel at its southernmost locality. The seed-tree-harvested system applied will be thoroughly considered because *G. volans* may not easily cross large openings in forests (Bendel and Gates 1987; Campuzano-Chávez-Peón et al. 2014; Cassola 2016).

Interestingly, Bueno-Cabrera et al. (2015) reported a record of *G. volans* in an area of forest logging in Chignahuapan, Puebla, Mexico, which suggests that proper silvicultural practices within managed forests may help in the conservation of *G. volans*. However, specific conservation actions are needed to effectively rescue this species.

Some of the activities that are going to be included in the annual managements and operative plans of Sansone company, based on the recommendations of Bueno-Cabrera et al. (2015) and Cassola (2016), are to increase the number and quality of tree seedlings that will grow into the canopy (e.g., including all the tree species reported with nest holes made by any woodpecker species), reducing illegal logging, and educating local residents on the need to protect pine ecosystems and rare animals like *G. volans*. Additionally, within the 3139.62 ha of the management plan of Las Lechuzas, there are 836.63 ha that have been declared as hydrological protection zones. Currently, there is no record of *G. volans* in any protected area in Honduras.

Even though the new record signifies the rediscovery of *G. volans* in Honduras after 43 years, the ecology, natural history, and main threats are unknown at the newly discovered, southernmost locality. Sciurids are probably among the arboreal mammals most sensitive to the removal of natural forest and other anthropogenic activities (Campuzano-Chávez-Peón et al. 2014).

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Author Contributions

Conceptualization: NOG. Funding acquisition: JM, MTC. Investigation: CL, MTC, GH, JM. Methodology: MTC, GH. Project administration: MTC. Resources: CM, FM. Validation: GH, MTC, CM. Writing – original draft: NOG, CL, MTC, FM. Writing – review and editing: FM, MTC, GH, JM, CL, NOG.

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